

# Muscular Strength and Cardiorespiratory Fitness on Osteopenia in Older Adults

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## ABSTRACT

**PURPOSE:** We examined the independent associations of muscular strength (MS) and cardiorespiratory fitness (CRF) with the prevalence of osteopenia in older adults. **METHODS:** Participants were free of cancer treatment in past five years and major medical issues that would interfere with physical activity. MS was assessed by 1-repetition maximum (1-RM) leg press (lbs) and CRF was assessed by time (minutes) to complete a 400-meter walk test. Both MS and CRF levels were categorized into four groups based on the sex-specific quartiles of each MS and CRF. Bone mineral density was assessed by dual-energy X-ray absorptiometry (DXA), and osteopenia (pre-osteoporosis stage) was defined as t-score below -1.0 following the World Health Organization guidelines. Logistic regression models included age, sex, heavy alcohol consumption (>14 drinks per week for male, >7 for female), smoking status, and leisure-time physical activity. **RESULTS:** The prevalence of osteopenia was 45.4% (n=138) in this study. Compared to the lower MS quartile 1 (lowest 25%), ORs (95% CIs) of osteopenia in MS quartiles 2, 3, and 4 were 0.75 (0.36-1.58), 0.33 (0.15-0.73), and 0.25 (0.11-0.59), respectively, after adjusting for age, sex, heavy alcohol consumption, smoking status, physical activity, and CRF. However, we found that CRF was not significantly associated with the prevalence of osteopenia after adjusting for the confounders including MS in this study (trend P=0.19). In the stratified analysis by CRF, we found that higher MS was significantly associated with lower prevalence of osteopenia in both low CRF (lower 50%) (trend P=0.02) and high CRF (higher 50%) (trend P=0.03) after adjusting for age, sex, heavy alcohol consumption, smoking status, and leisure-time physical activity. **CONCLUSION:** This study found that higher MS, independent of CRF, was associated with a lower prevalence of osteopenia in older adults.

## INTRODUCTION

Previous studies on this topic focused mostly on women only, especially menopausal women, and were limited in sample size (n<100).

## METHODS

### Participants:

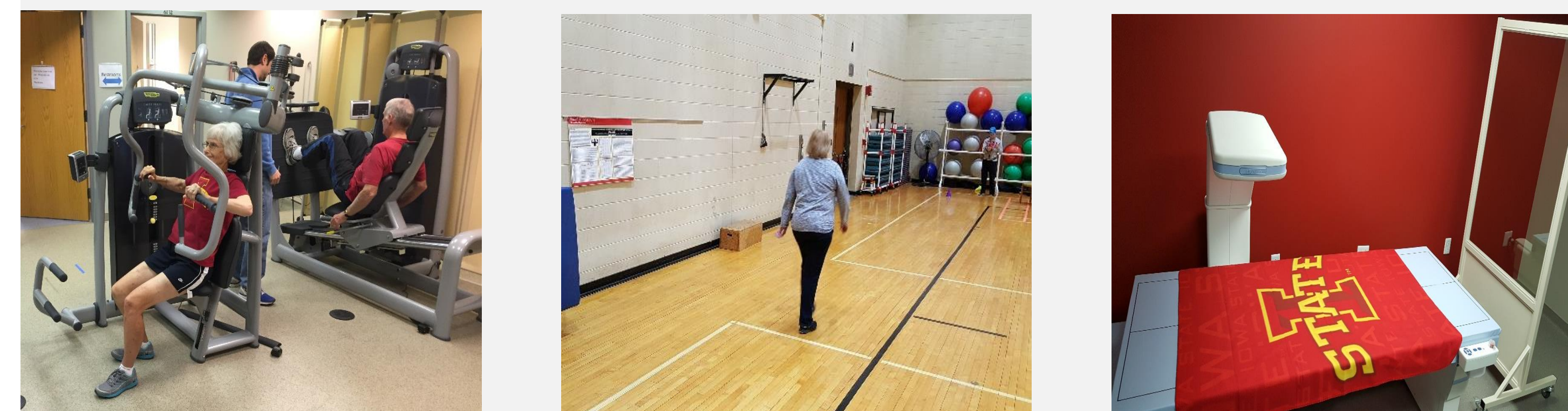
- 304 older adults aged 66 to 97 years (mean age 74±6).
- Participants were free of cancer treatment in past five years and major medical issues that would interfere physical activity.

### Muscular Strength and Cardiorespiratory Fitness:

- MS was assessed by 1RM leg press (lbs) and CRF was assessed by time (minutes) to complete a 400-meter walk test.
- Participants were classified into MS and CRF quartiles (lowest 25%/quartile 1: reference).

### Bone Mineral Density:

- Bone mineral density was measured by DXA.
- The prevalence of osteopenia was 45.4% (n=138; 41 men, 97 women).



### Statistical Analysis:

- Logistic regression models for MS included age, sex, heavy alcohol consumption, smoking status, leisure-time physical activity, and CRF.
- Logistic regression models for CRF included age, sex, heavy alcohol consumption, smoking status, leisure-time physical activity and MS.

## RESULTS

Table 1. Participant Characteristics by Sex

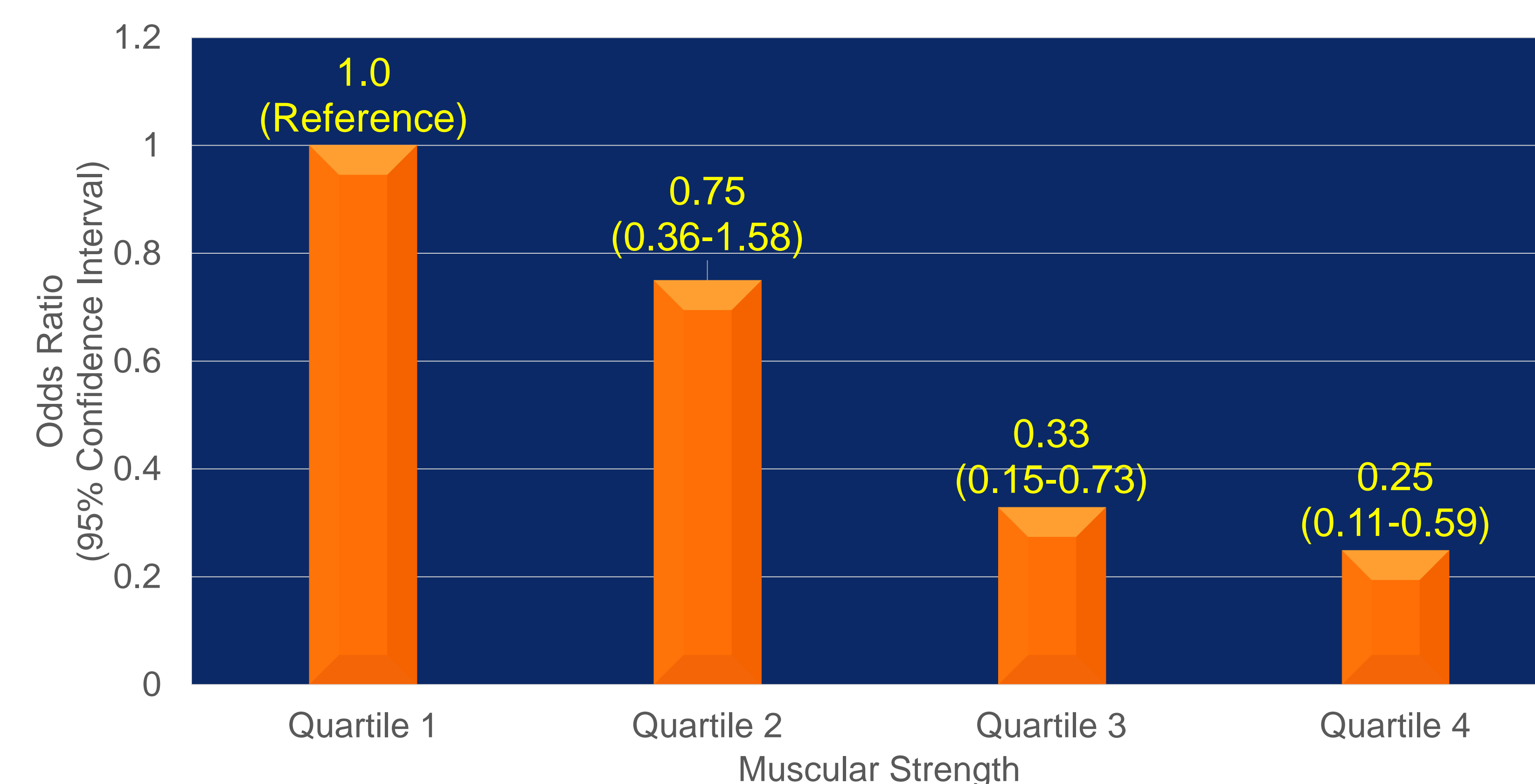
Characteristic	Men	Women
Sample Size	127	177
Age (year)	74.4 (6.0)	74 (5.7)
Bone Mineral Density (T-score)	-0.31 (1.44)	-1.01 (1.51)
Muscular Strength (lbs)	241.5 (73.3)	141.7 (49.0)
Cardiorespiratory Fitness (minute)	4.3 (0.8)	4.6 (0.8)
Leisure-time Physical Activity (MET-hours/week)†	31.7 (25.0)	25.6 (29.1)
Heavy Alcohol Consumption‡	4 (3.2)	12 (6.8)
Current Smoker	1 (0.8)	2 (1.1)

Data are mean (SD) or %. MET denotes metabolic equivalent.

†Total amount of moderate or vigorous physical activities such as running, golfing, dancing, and etc.

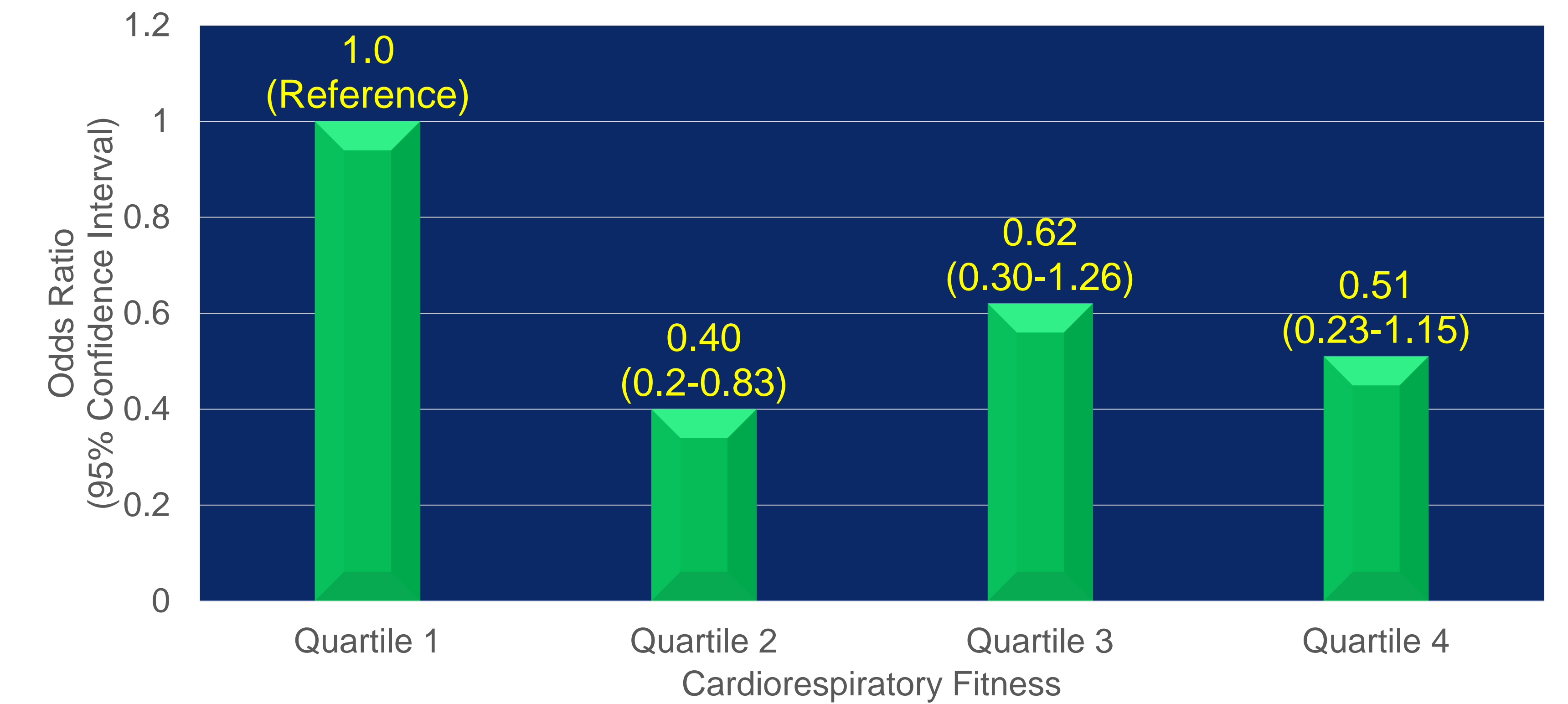
‡Defined as alcohol drinks >14 and >7 per week for men and women, respectively.

Figure 1. Odds Ratios of Osteopenia by Muscular Strength\*



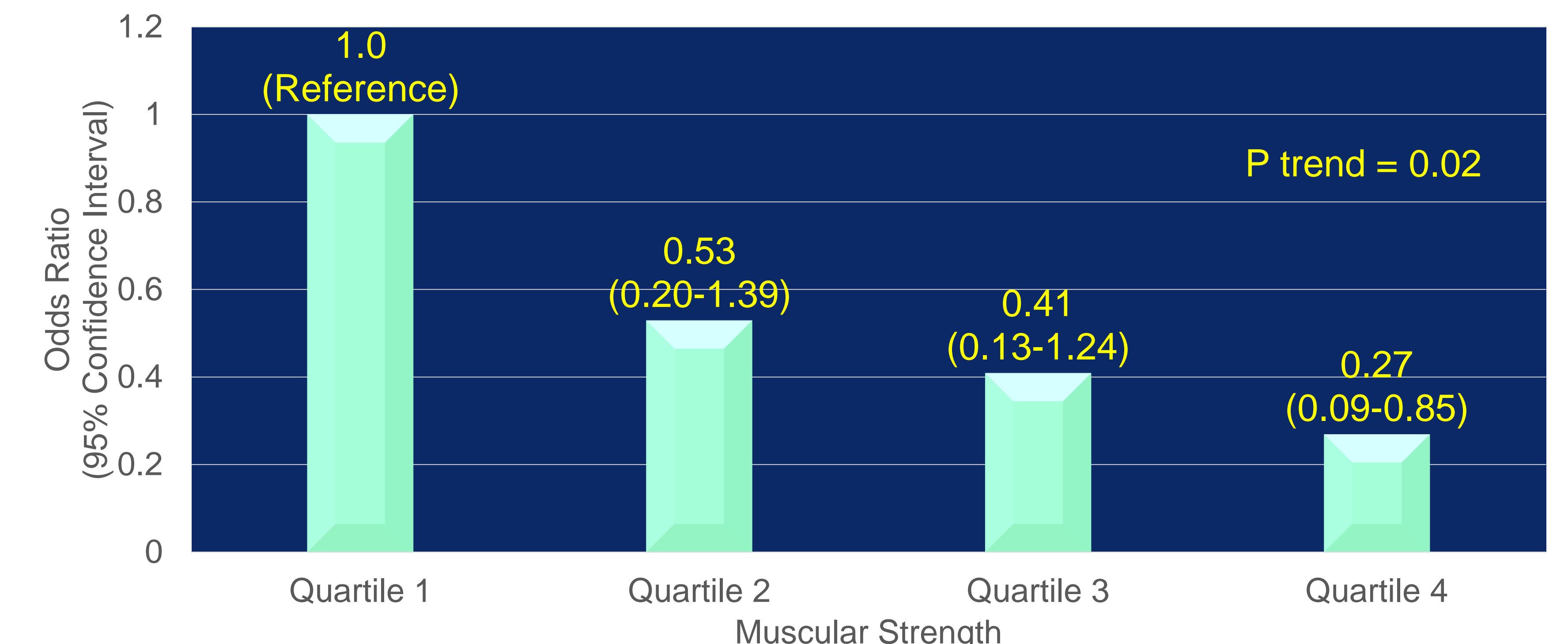
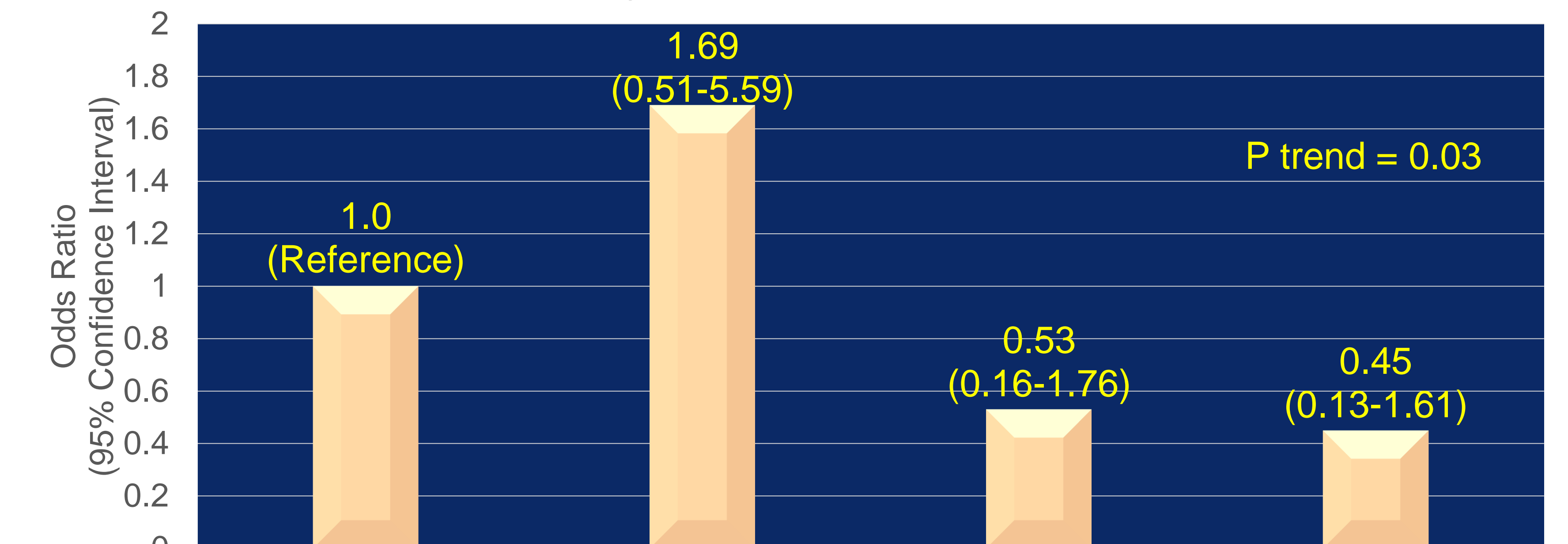
\*Adjusted for age (years), sex, smoking status (never, former, or current), heavy alcohol drinking (yes or no), moderate or vigorous physical activities, and cardiorespiratory fitness (minute).

Figure 2. Odds Ratios of Osteopenia by Cardiorespiratory Fitness\*



\*Adjusted for age (years), sex, smoking status (never, former, or current), heavy alcohol drinking (yes or no), moderate or vigorous physical activities, and muscular strength (lbs).

Figure 3 and 4. P-trends for Higher 50% CRF (above) and Lower 50% CRF (below)\*



\*Adjusted for age (years), sex, smoking status (never, former, or current), heavy alcohol drinking (yes or no), and moderate or vigorous physical activities.

## CONCLUSIONS

1. Higher muscular strength, independent of cardiorespiratory fitness, was associated with a lower prevalence of osteopenia in older adults.
2. The relationship between Cardiorespiratory fitness and bone mineral density was less clear and may require further exploration with larger sample.